

Irradiation of Mangoes, *Mangifera indica* L.

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Introduction

- South Africa mango production export driven
- India is the worlds largest producer
- Nigeria is Africa largest producer
- Mexico largest exporter
- USA and EU largest importer
- Quarantine disinfestation required against:
 - Mango seed weevil, *Sternochetus mangifera* Fabricius
 - Mediterranean fruit fly, *Ceratitis capitata* Wiedemann
 - Marula fruit fly, *Ceratitis cosyra* Walker
 - Natal fruit fly, *Ceratitis rosa* Karsch
 - (Asian fruit fly, *Bacterocera papayae* Drew & Hancock)

- Deregistration of ethylene dibromide (EDB) in the USA in 1984
- Search for alternative methods for phytosanitary treatment of fruit and vegetables
- Various methods explored include:
 - Hot water
 - Vapour heat
 - Gamma irradiation
- Hot water and vapour treatments not effective against mango seed weevil

- International accepted quarantine measures include:

- Heat treatment
- Pest free production sites
- Non-host status
- Gamma irradiation

- International standards for phytosanitary measures:

- Fruit flies - 250 Gy
- Seed Weevils - 300 Gy

- Irradiation reliable quarantine disinfestation treatment
- Accepted irradiation doses results in sterility of insects
- Countries that irradiate and export mango include: China, India, Hawaii and Australia
- Mexico dominates US market - Feb to Sept
- Brazil dominates rest of the year

Materials and Methods

■ Aim:

- Determine the effects of irradiation on new and existing cultivars

Cultivars:

- Shelly
- Honey Gold
- Keitt
- Kent

■ Treatments:

- 1. Pre-chill, pre-cold storage and irradiation
- 2. Pre-chill, irradiation and post-cold storage
- 3. No pre-chill, irradiation and post-cold storage

■ Logistics:

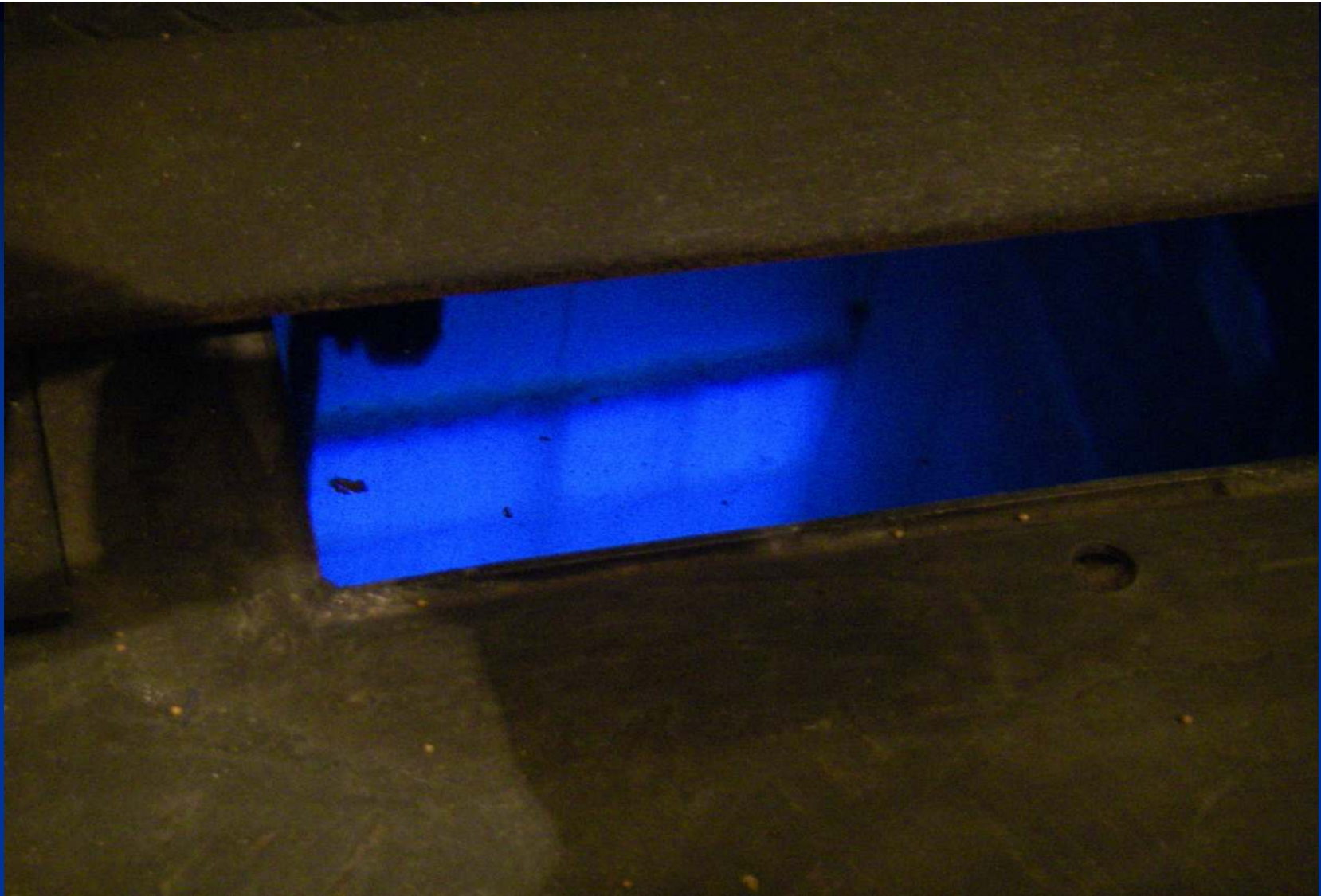
- Monday – Fruit picked and standard pack house treatment Not for treatment 3)
- Wednesday - Transported to Pietermaritzburg at 10⁰C air temperature
- Thursday – Fruit collected from market, weighed and stored at 9⁰C
- Saturday – Fruit irradiated Gamwave SA (Pty) Limited in Durban

■ Gamma irradiation

- Doses: 300, 400, 600 and 1000 Gy
- Stack of five cartons per dose
- Stack was turned 180° at half time
- Irradiation time influenced by product



■ Figure 1. Cartons stacked on trolleys facing the gamma radiation source.



■ Figure 2. Gamma radiation source submerged in water.

■ Dosimetry:

- Harwell Amber Perspex Dosimeter (Type 3042) Range 1-30kGy
- Dosimeters pre-dosed for 1.5-2 hrs
- Reading were taken with spectrometer and dose calculated



■ Fruit evaluation:

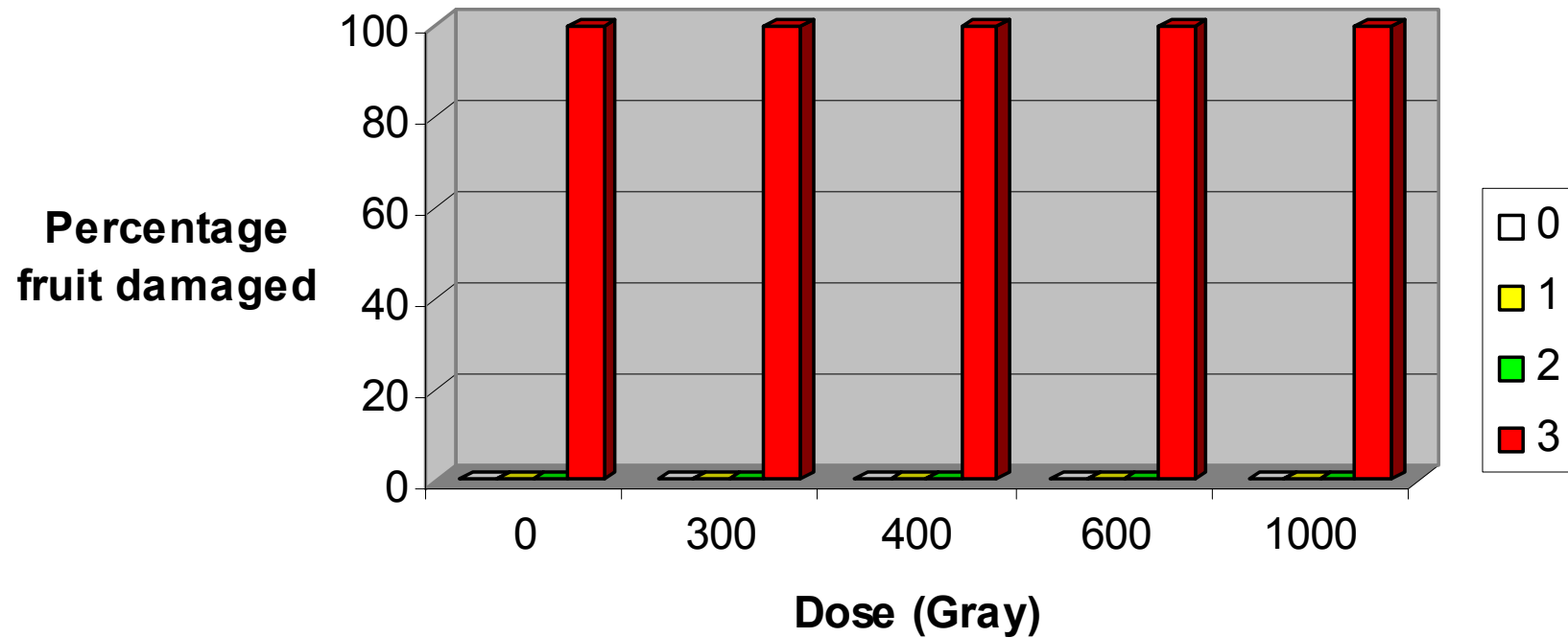
- Blush 0 – 3 (0 = no blush)
- Skin colouration 0 - 3 (0 = no colouration)
- Cold damage 0 – 3 (0 = no damage)
- Firmness - densimeter
- Lenticel damage (0 = no damage)
- Moisture loss
- Days to ripe
- Soft brown rot 0 – 3 (0 = no rot)
- Anthracnose 0 – 3 (0 = no anthracnose)
- Vascular browning
- Internal colour
- TSS (Brix)

Results and Discussion

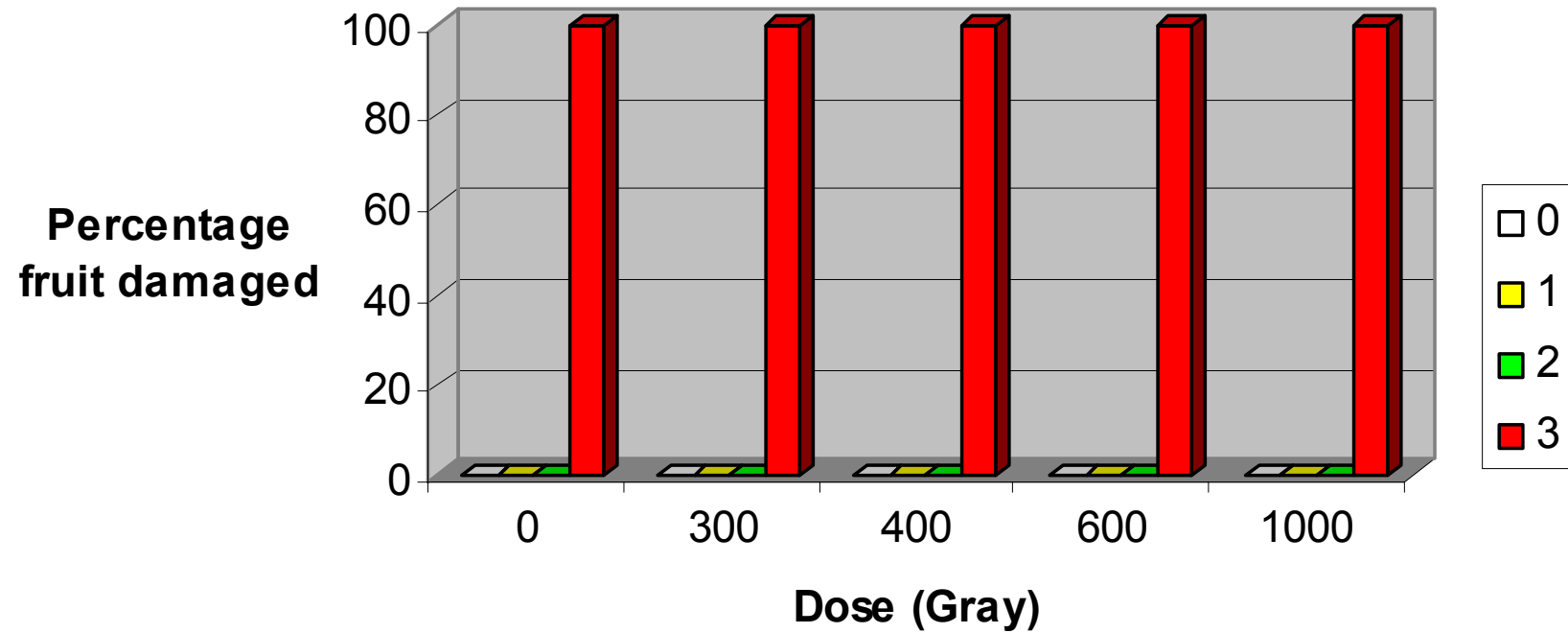
Cultivar	Aimed dose (Gy)	Dose for Treatment 1 (Gy)	Dose for Treatment 2 (Gy)	Dose for Treatment 3 (Gy)
Honey Gold and Shelly	300	260	366	366
	400	470	460	460
	600	710	590	590
	1000	1000	970	970
Keitt and Kent	300	290	310	310
	400	363	370	370
	600	680	646	646
	1000	1020	1035	1035

Lentice! damage

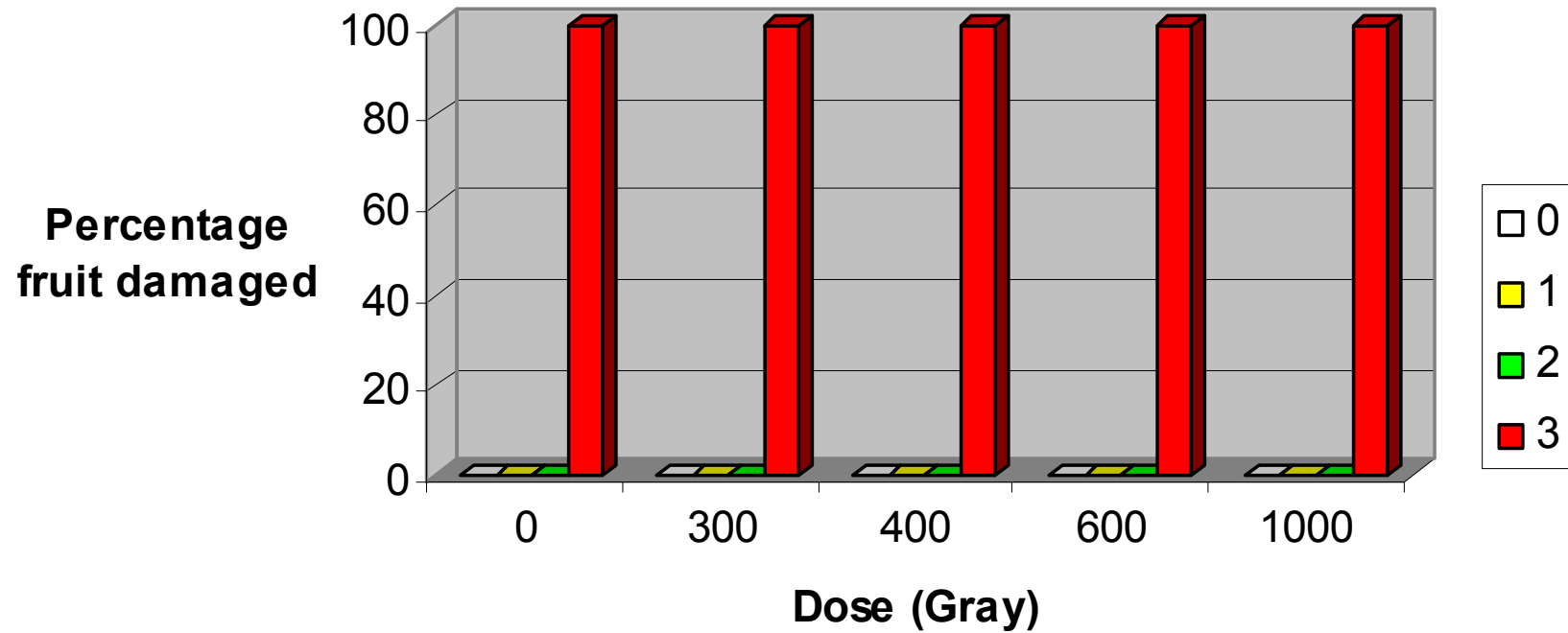
Honey Gold lentice! damage for Treatment 1



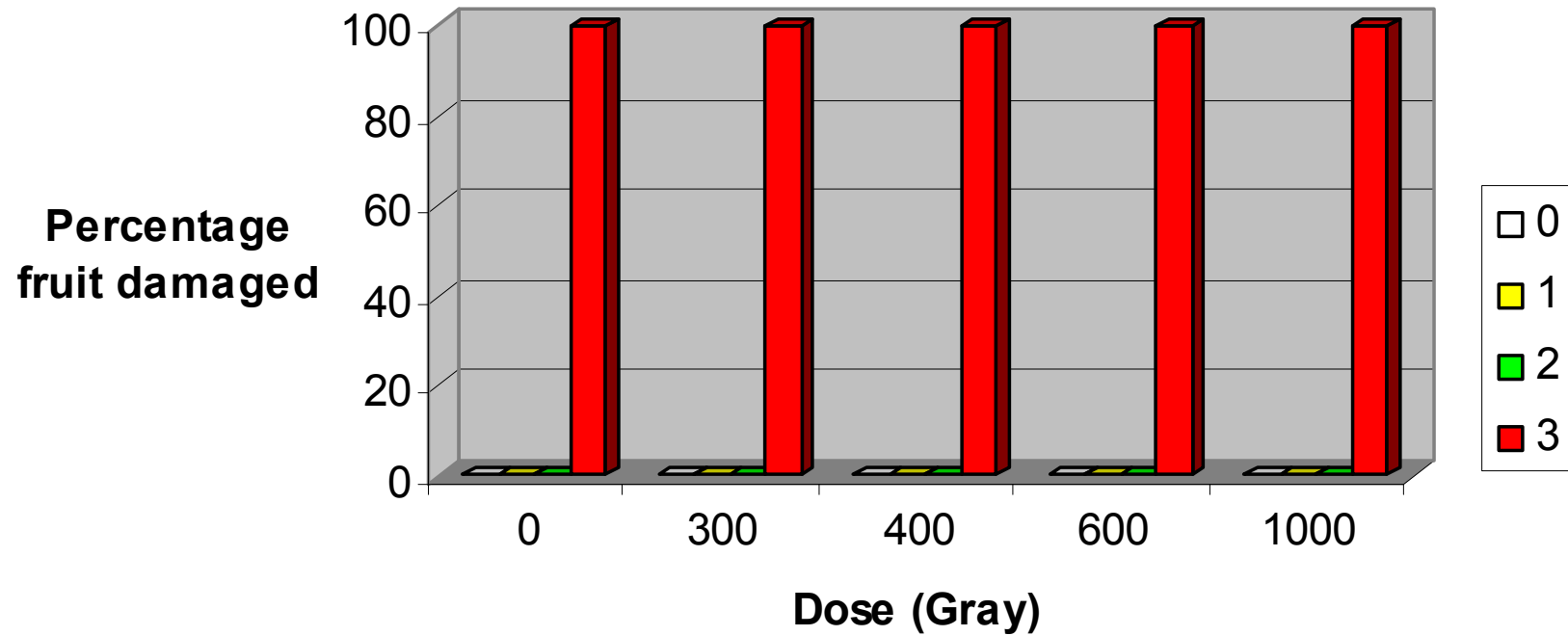
Honey Gold lenticel damage for Treatment 2



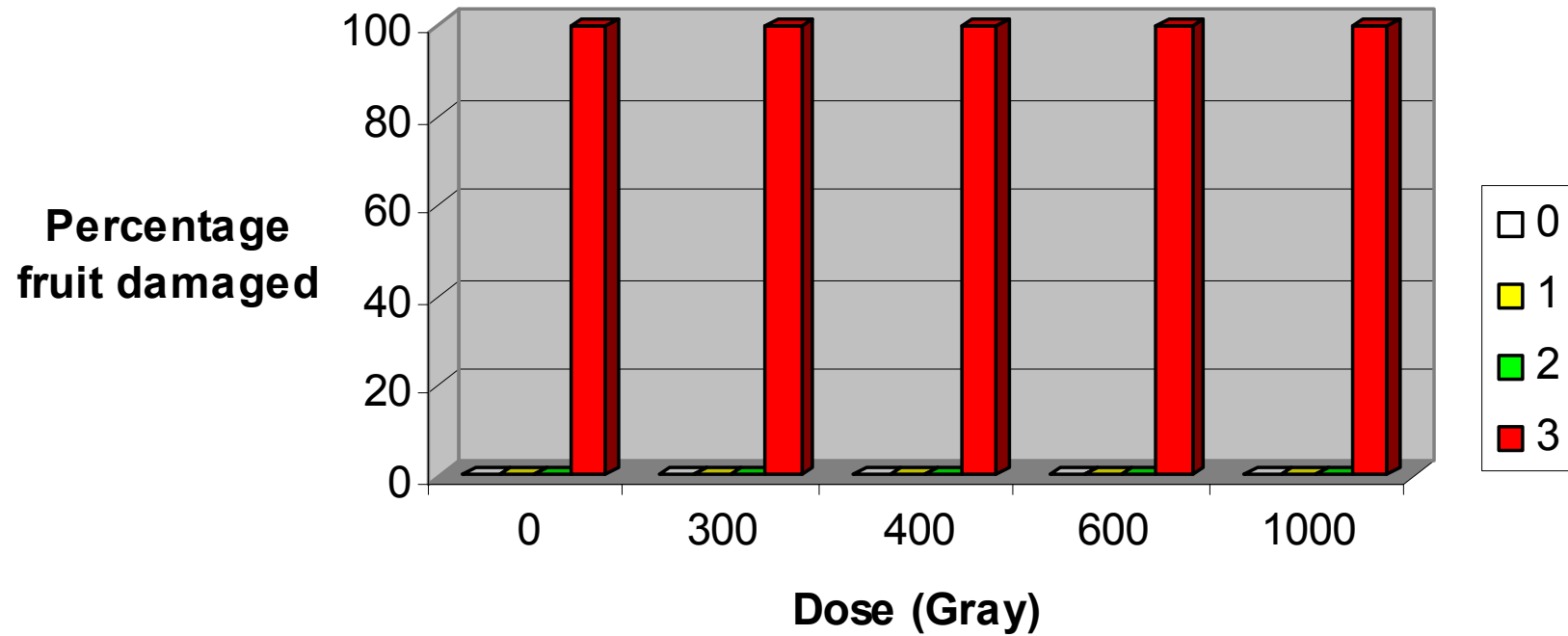
Honey Gold lentisel damage for Treament 3



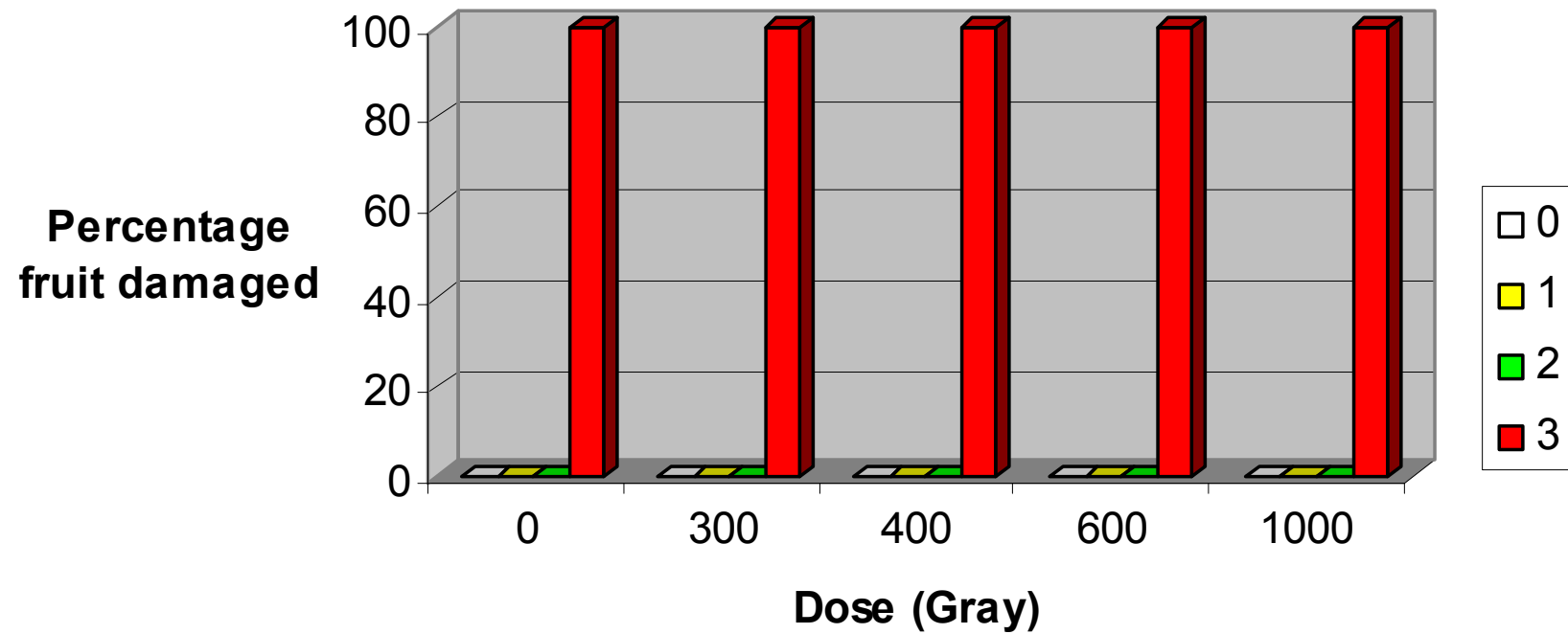
Shelly lenticel damage for Treament 1



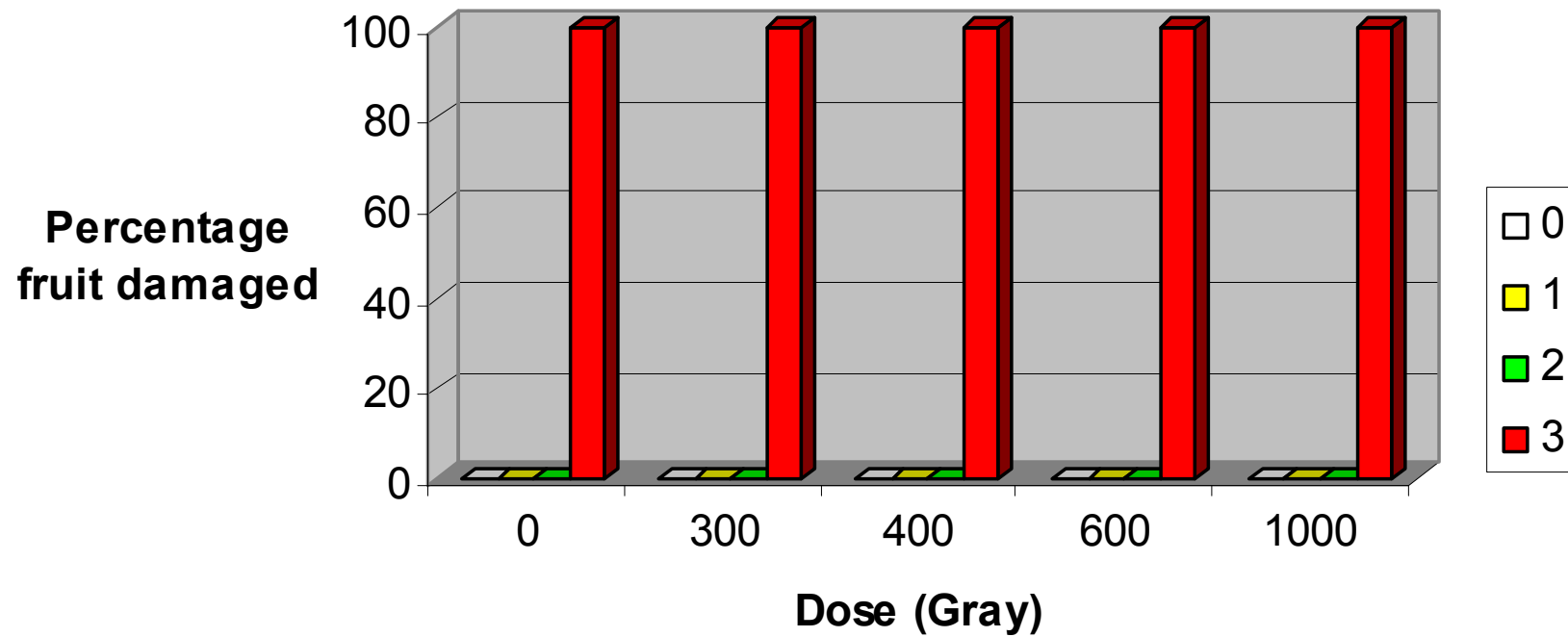
Shelly lenticele damage for Treatment 2



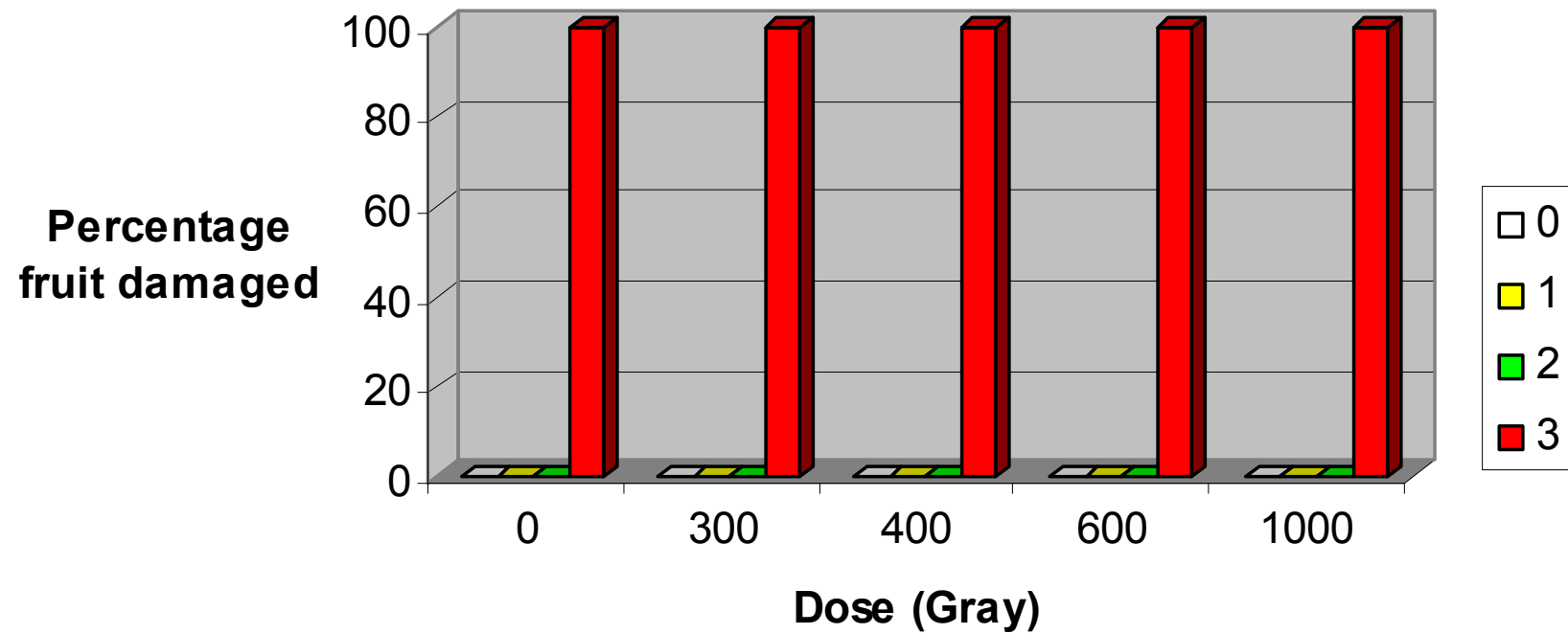
Shelly lenticel damage for Treatment 3



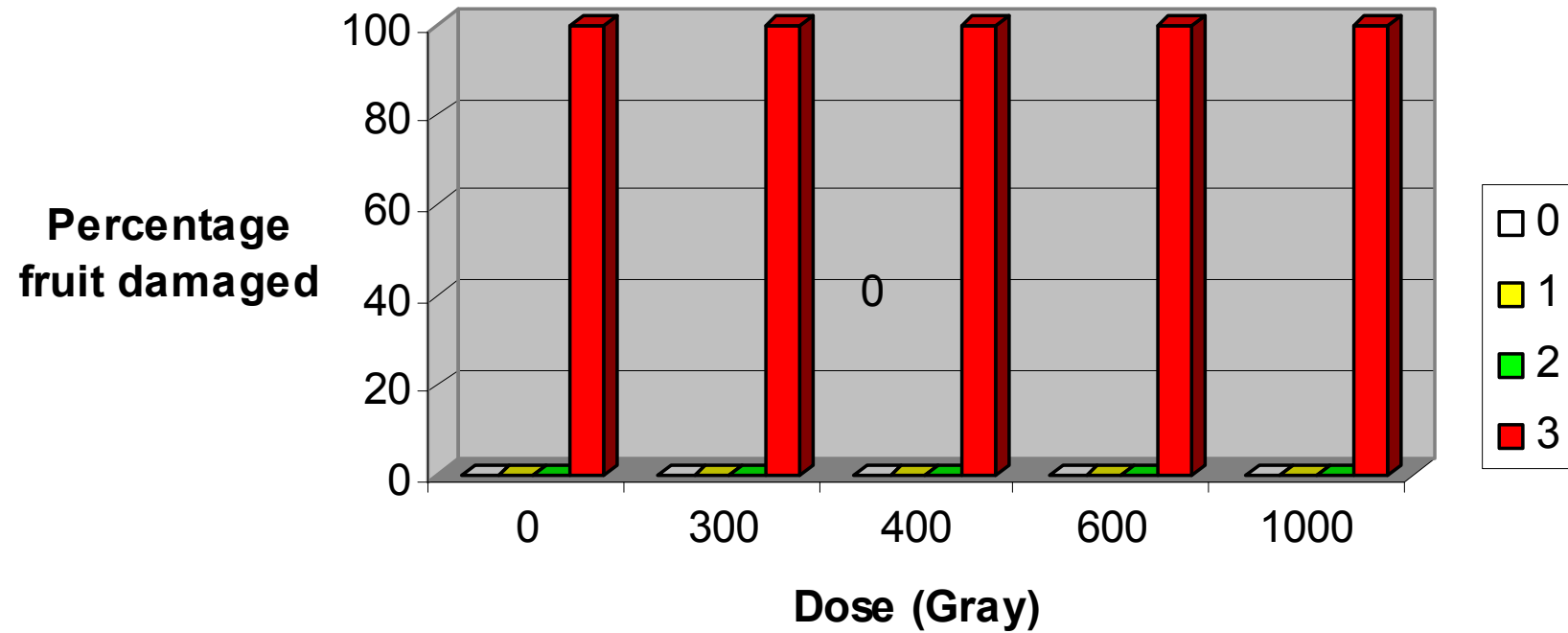
Keitt lenticel damage for Treatment 1



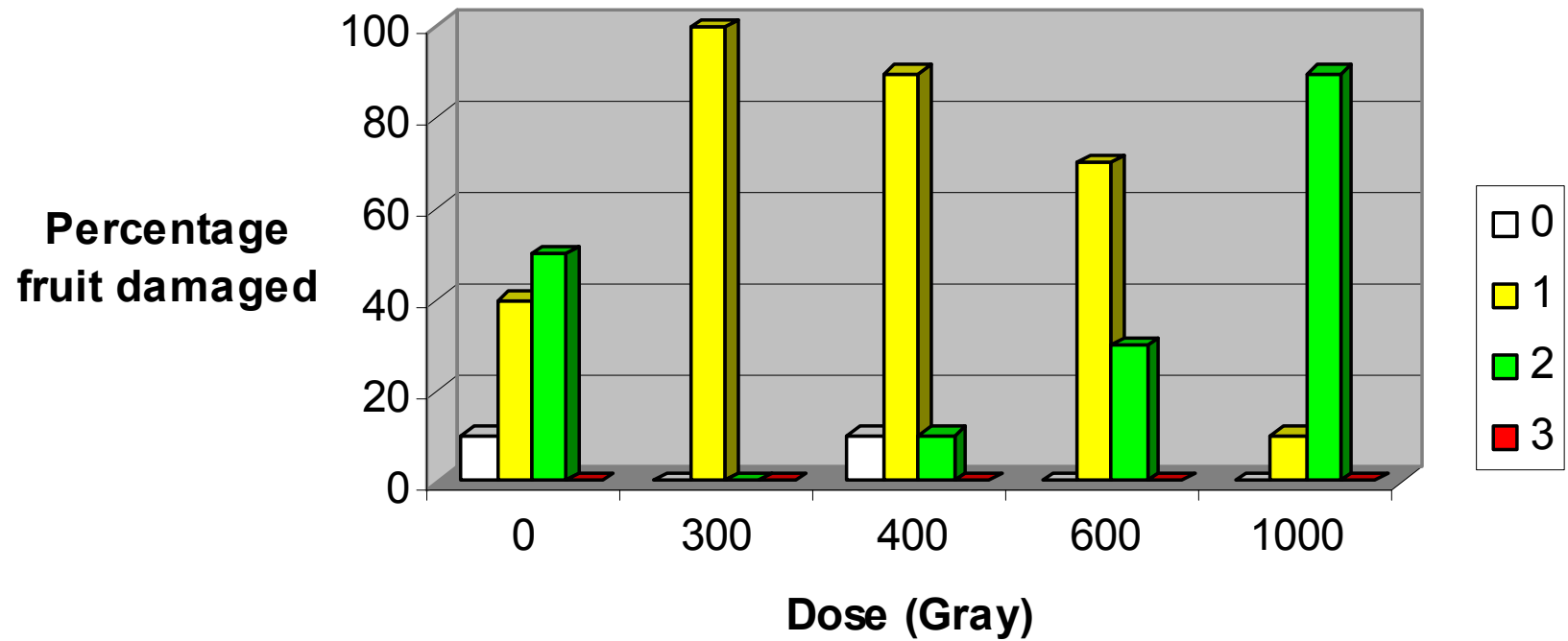
Keitt lentisel damage for Treatment 2



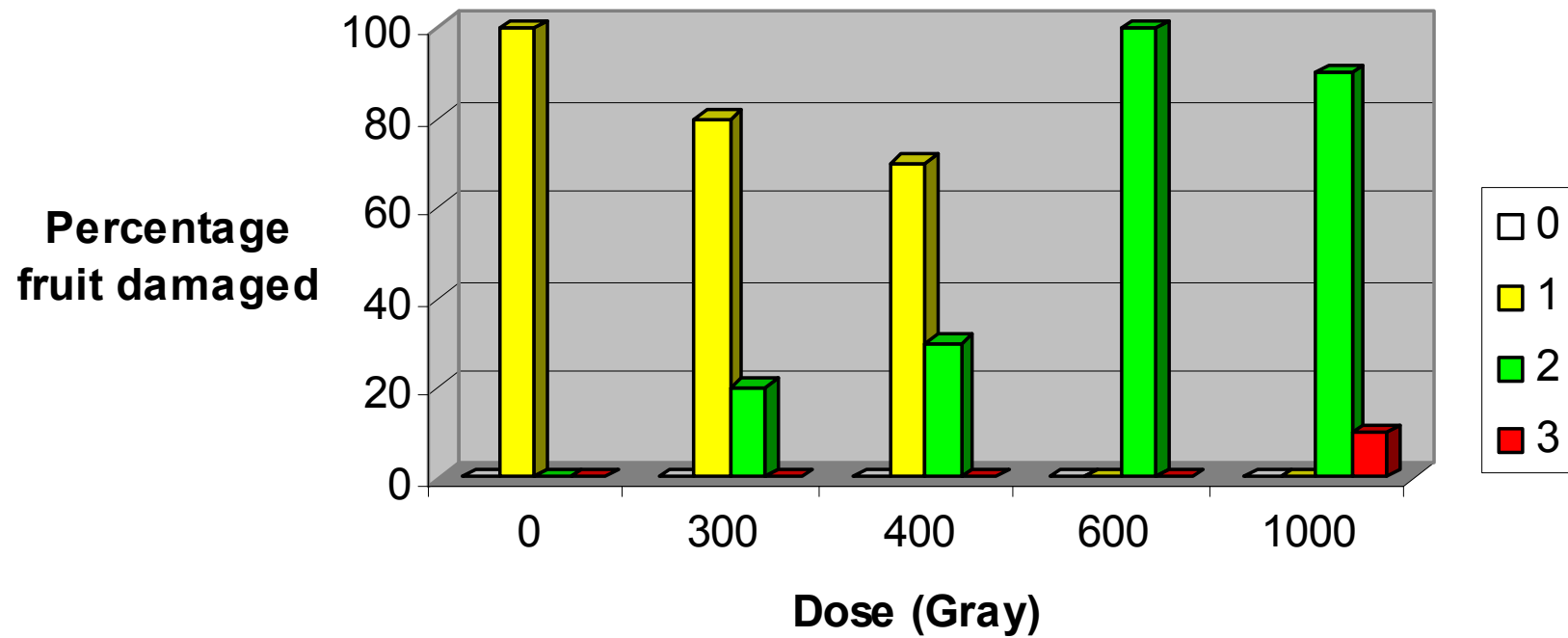
Keitt lentisel damage for Treatment 3



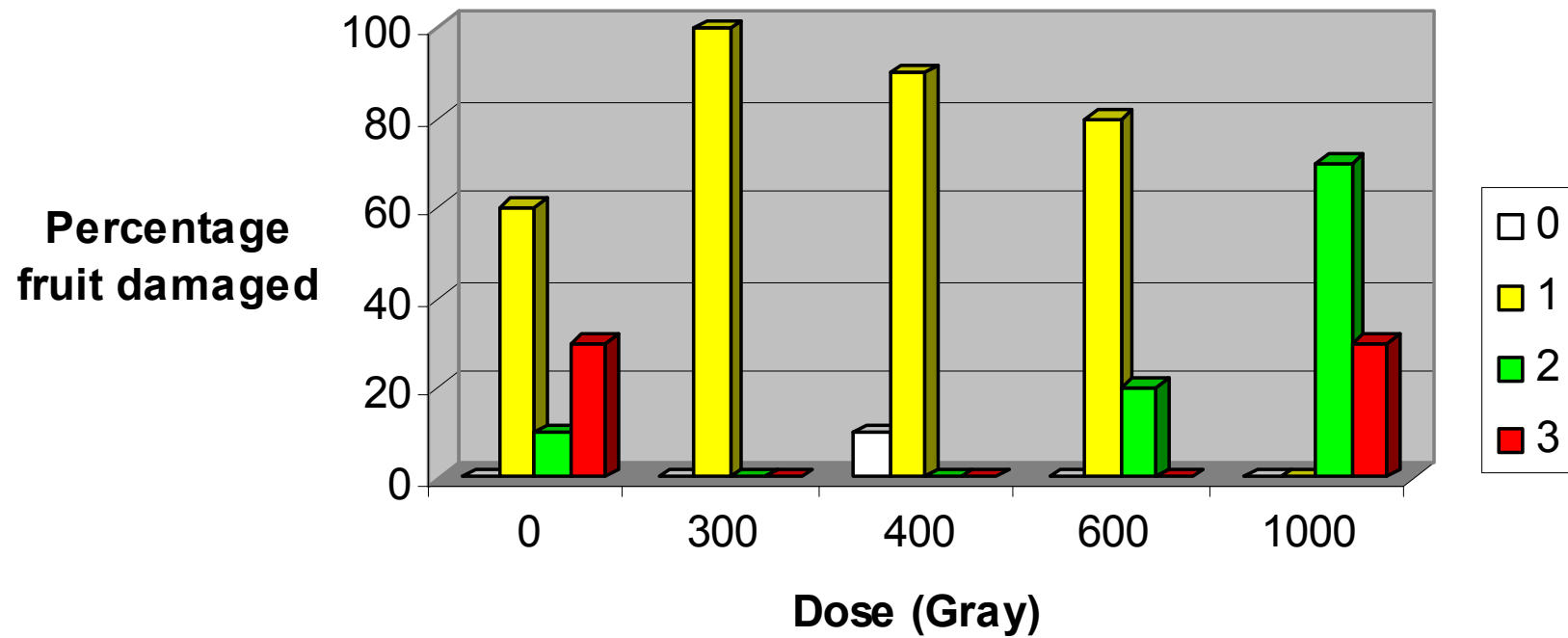
Kent lenticel damage Treatment 1



Kent lenticel damage for Treatment 2

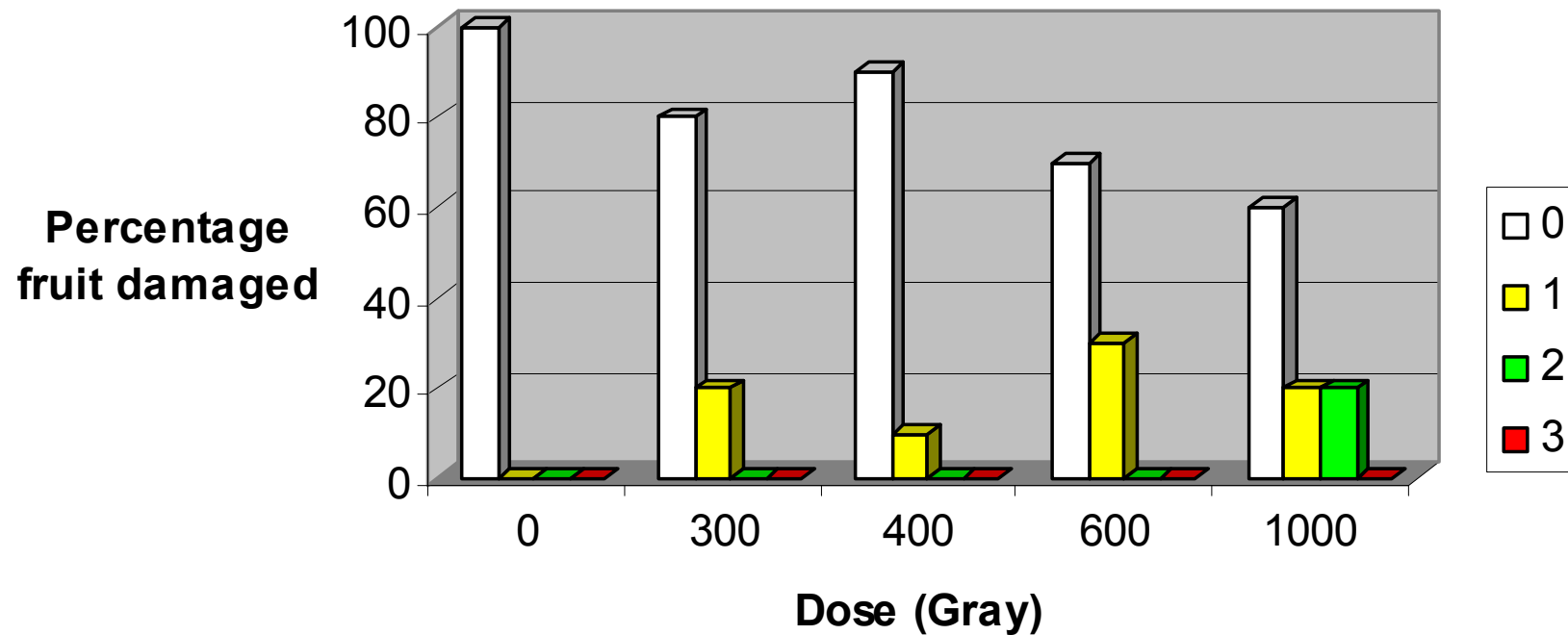


Kent lenticel damage for Treatment 3

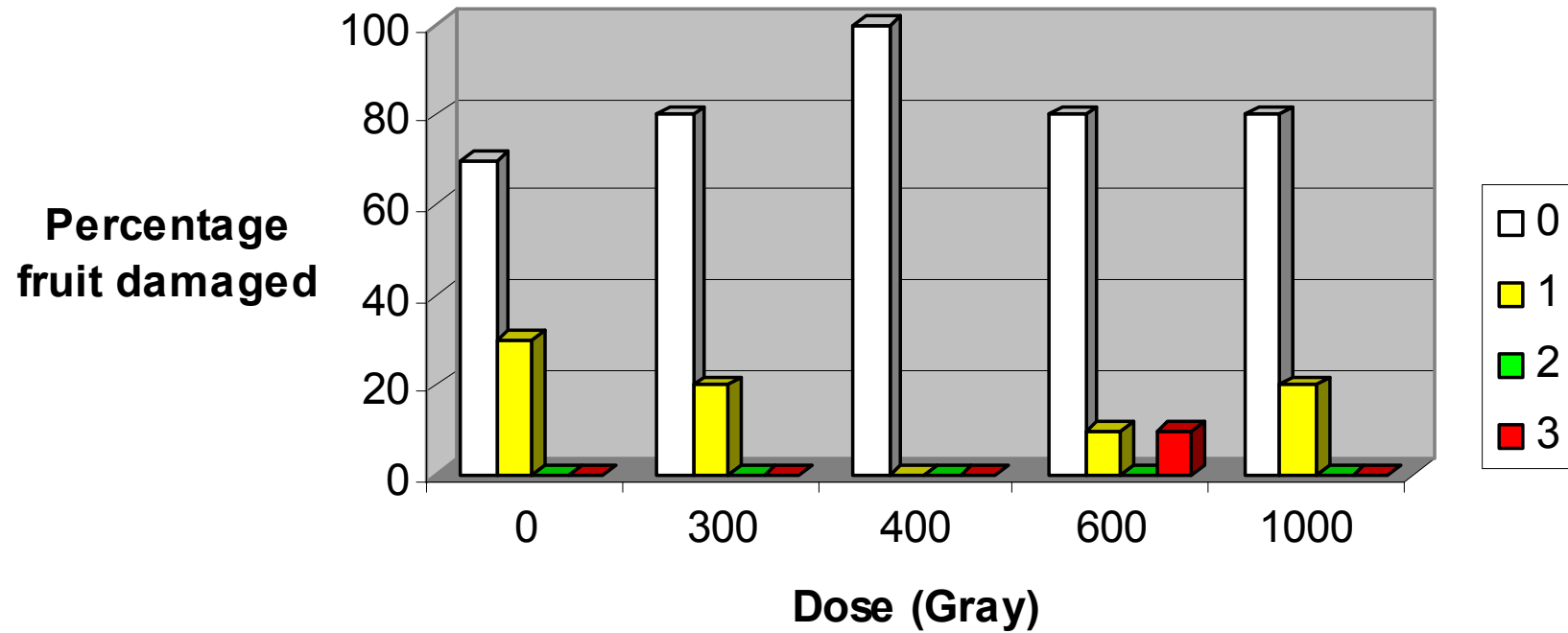


Cold damage

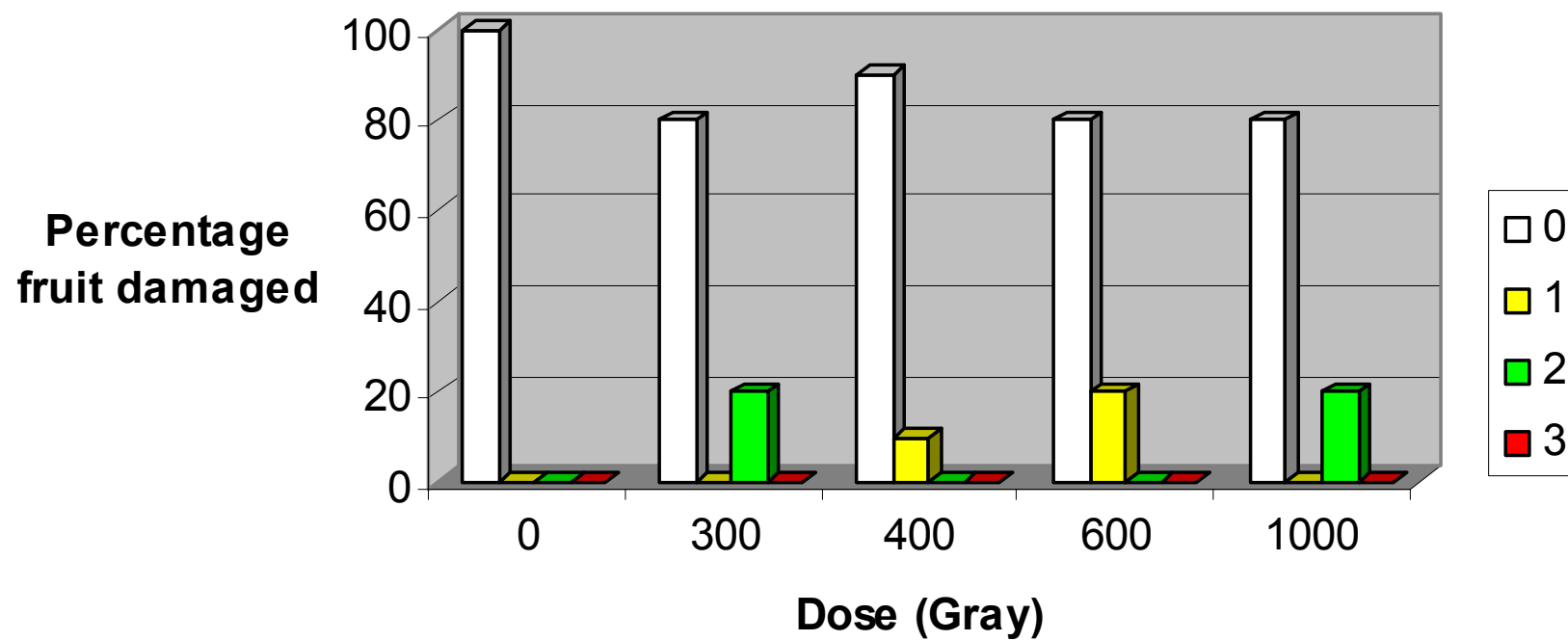
Honey Gold cold damage for Treatment 1



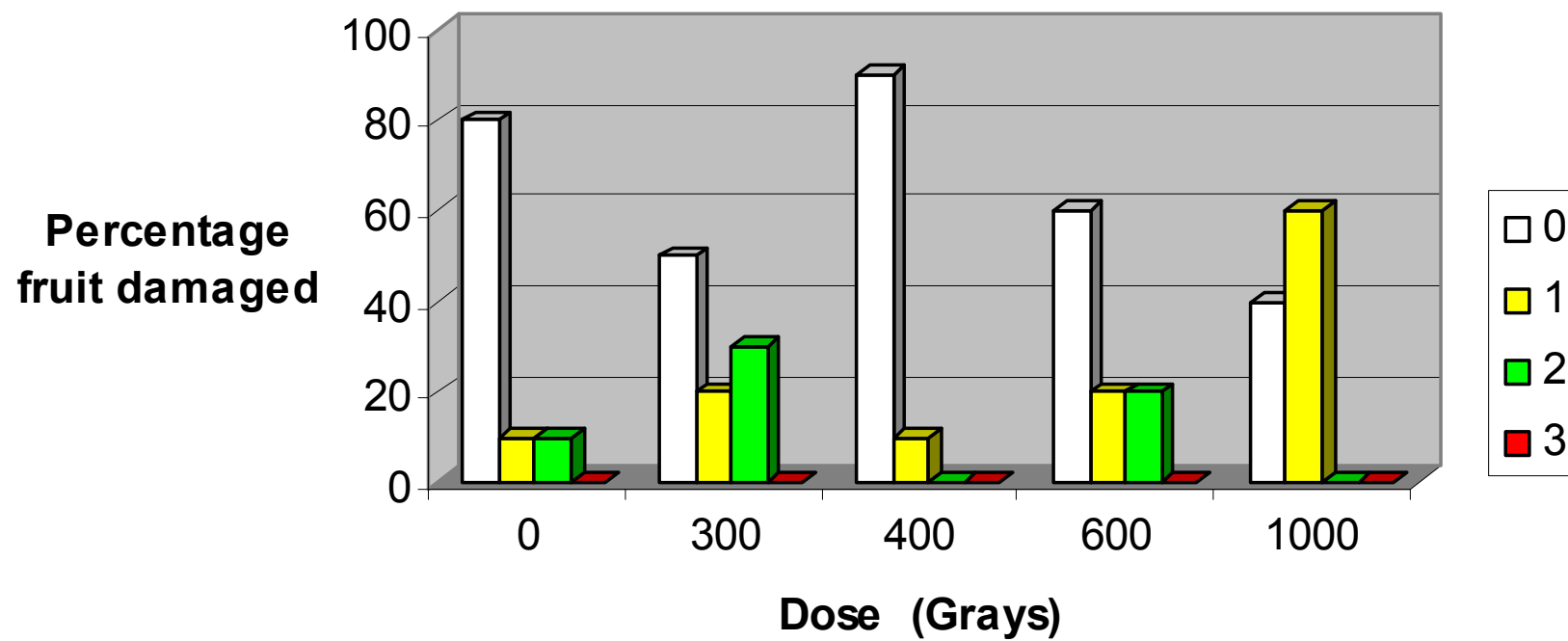
Honey Gold Cold damage for Treatment 2



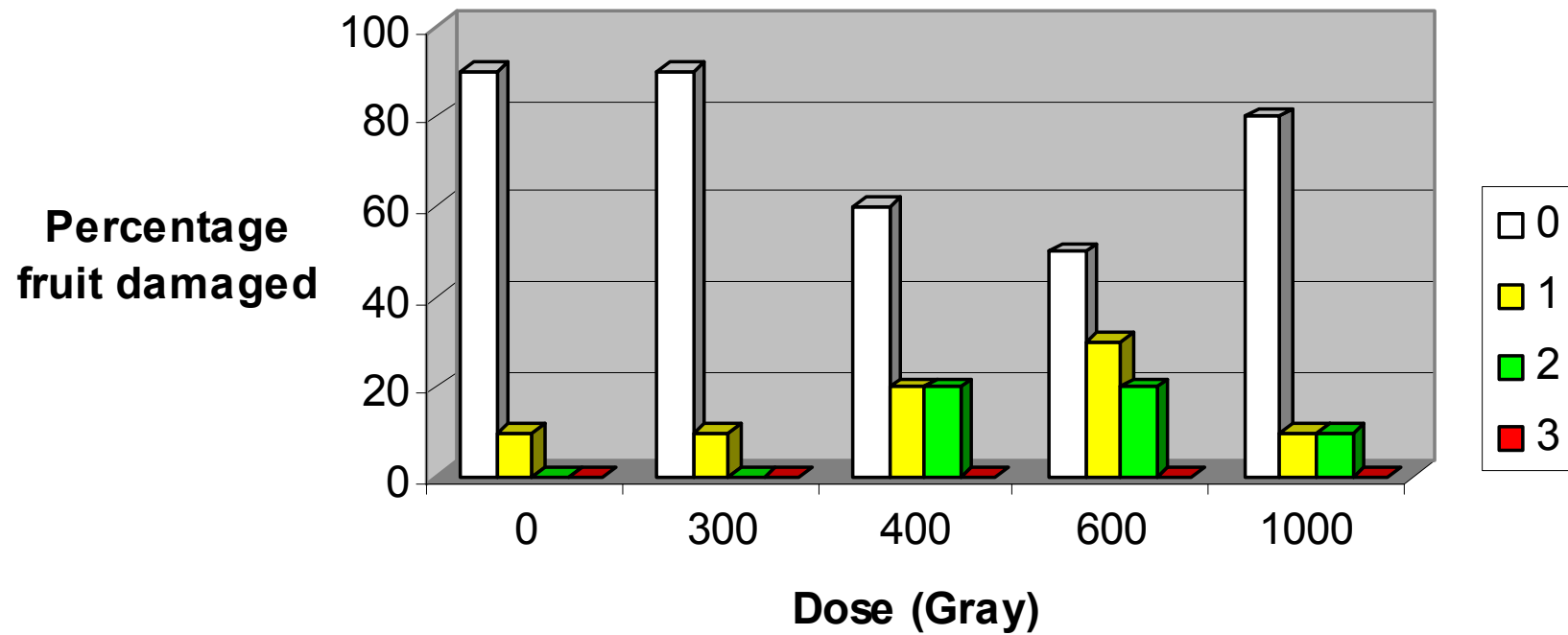
Honey Gold cold damage for Treatment 3



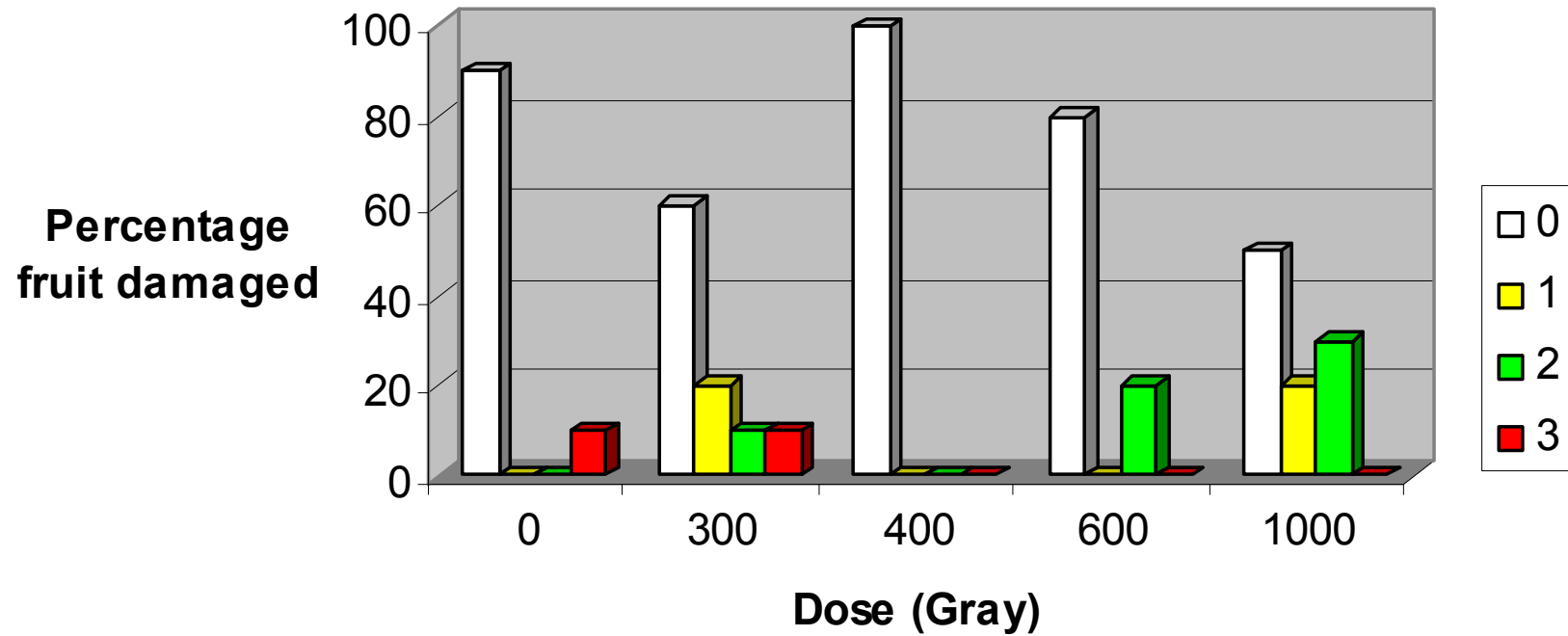
Shelly cold damage for Treatment 1



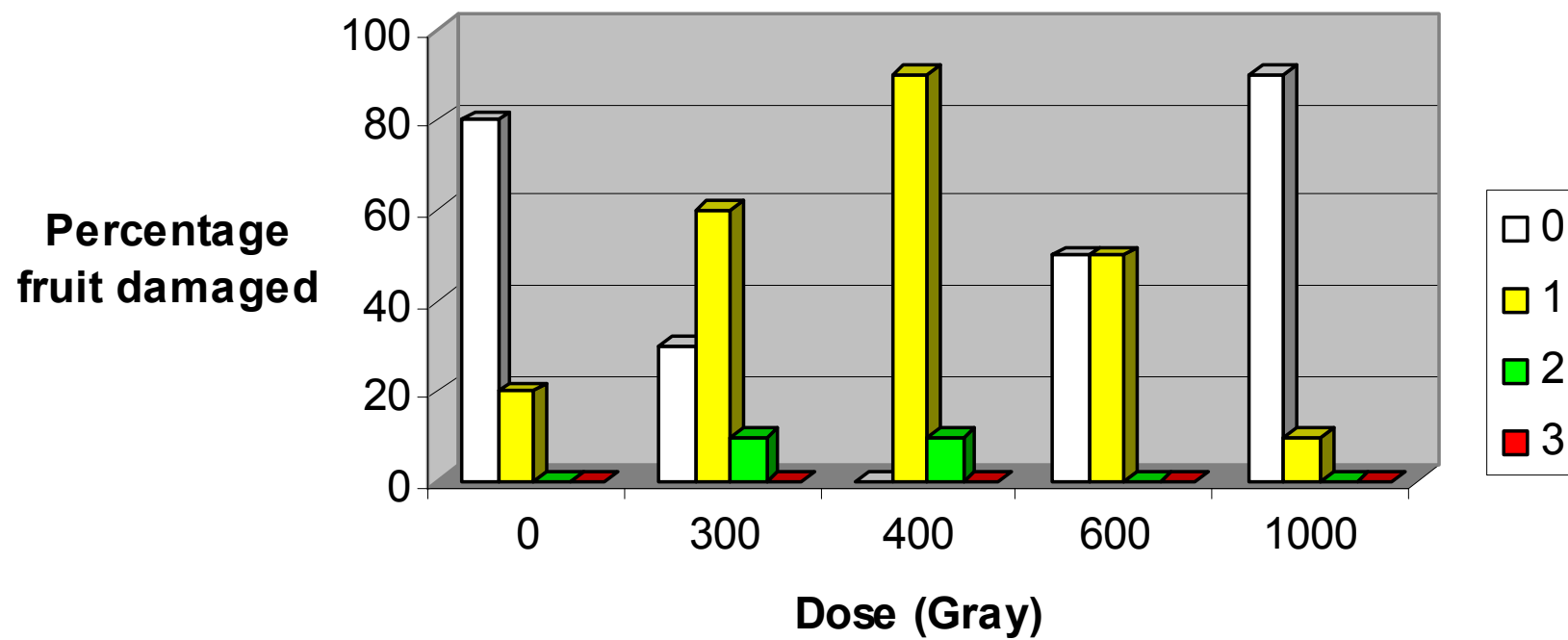
Shelly Cold damage for Treatment 2



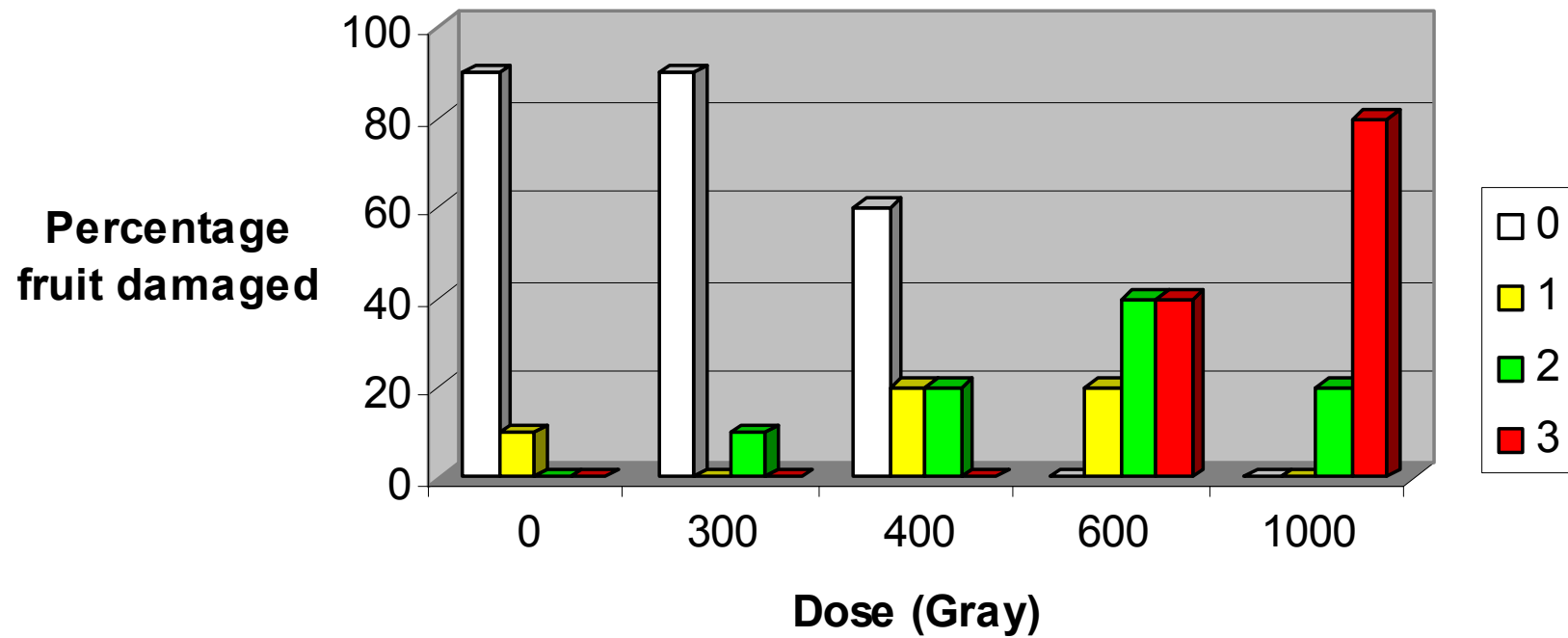
Shelly cold damage for Treatment 3



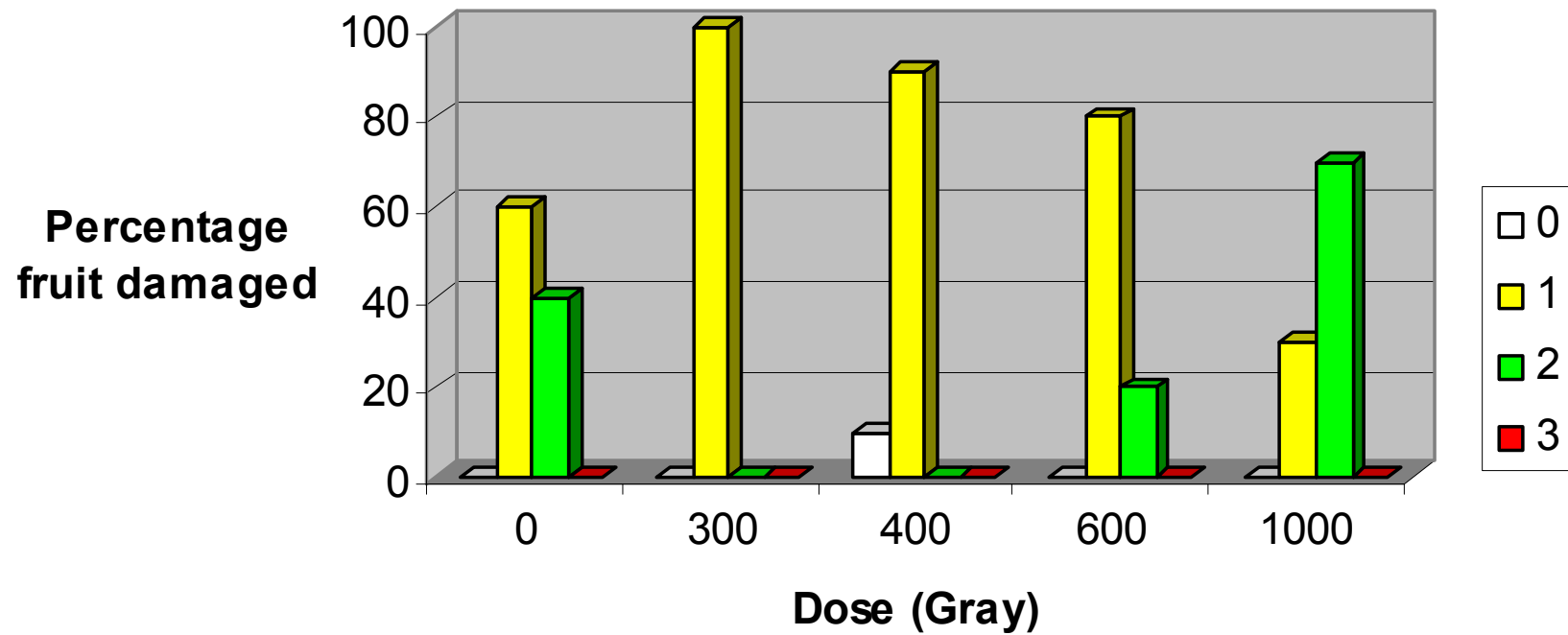
Keitt cold damage for Treatment 1



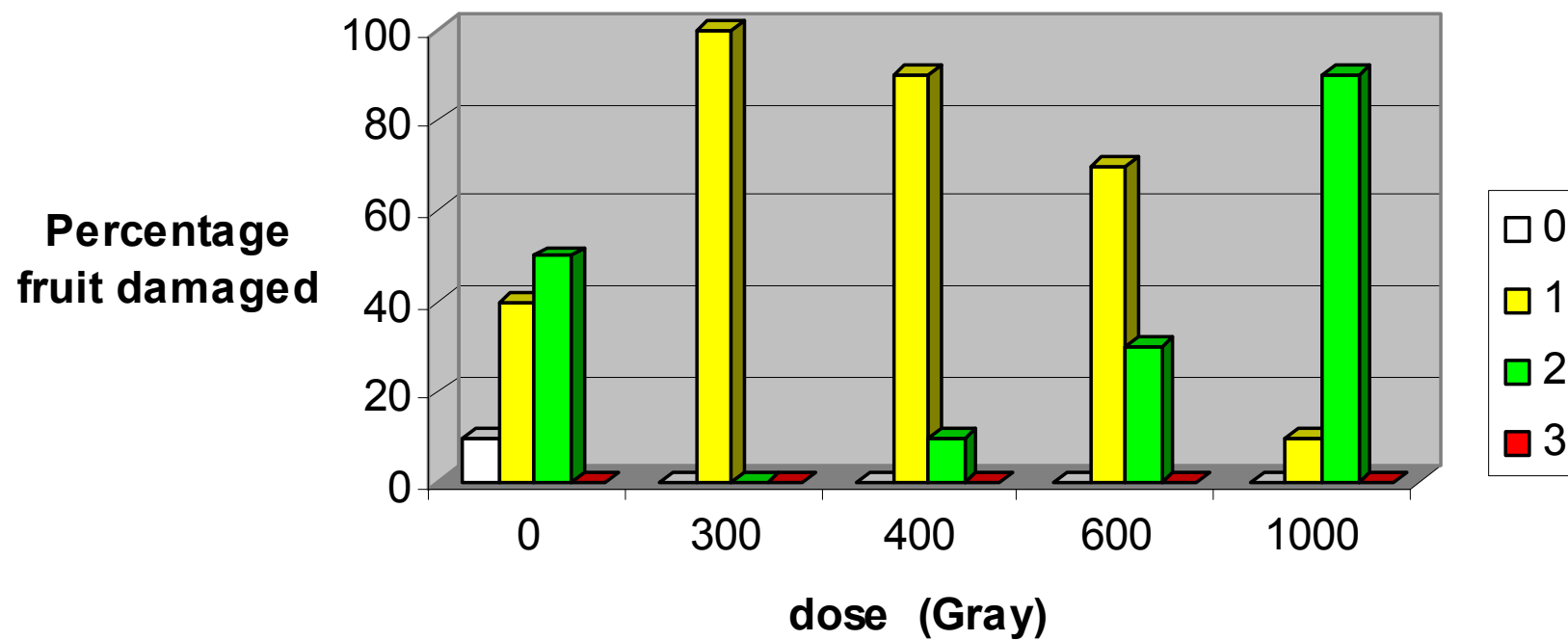
Keitt cold damage for Treatment 2



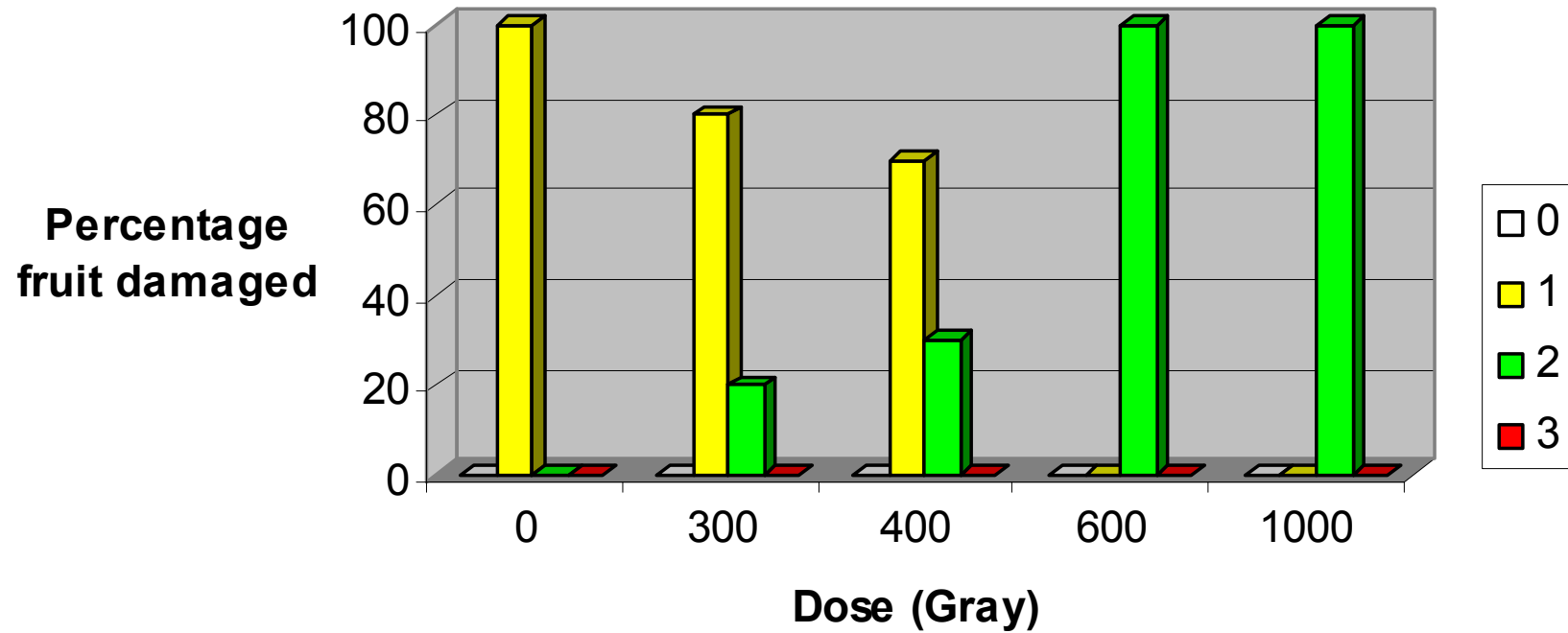
Keitt cold damage for Treatment 3



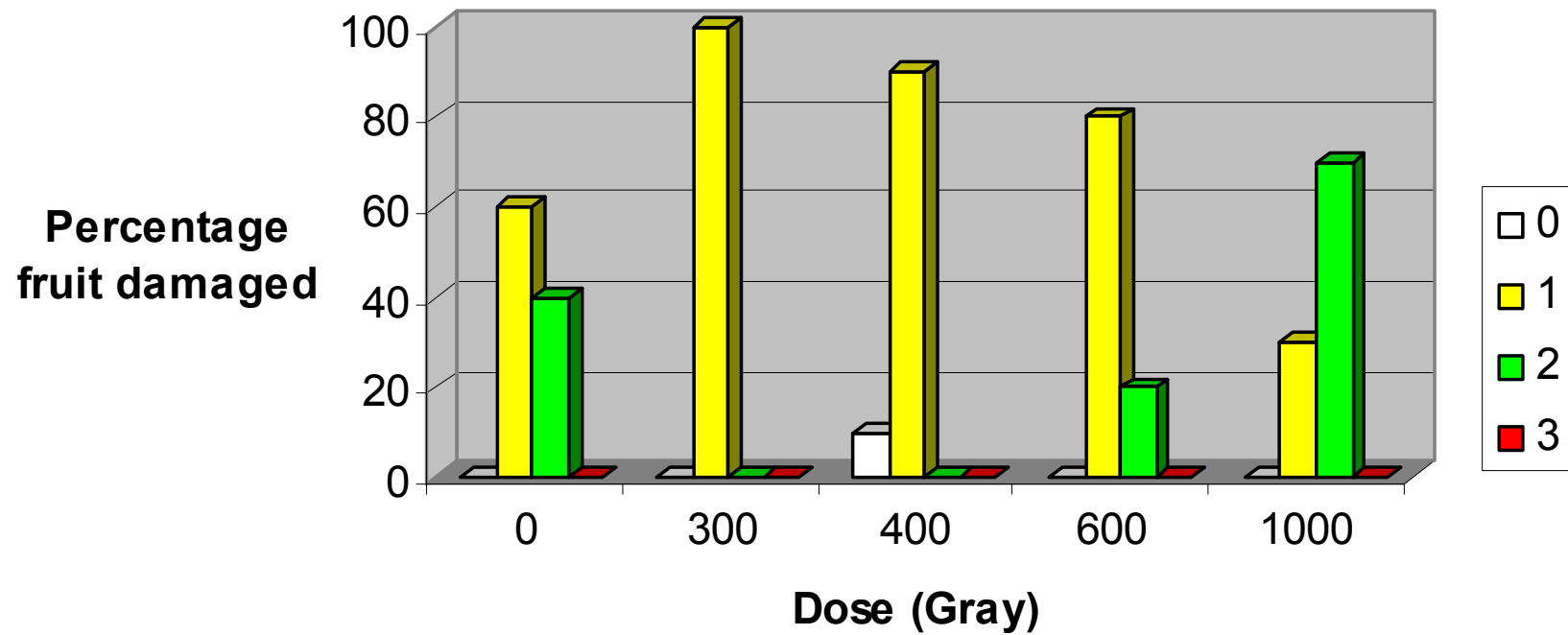
Kent cold damage for Treatment 1



Kent cold damage for Treatment 2



Kent cold damage for Treatment 3

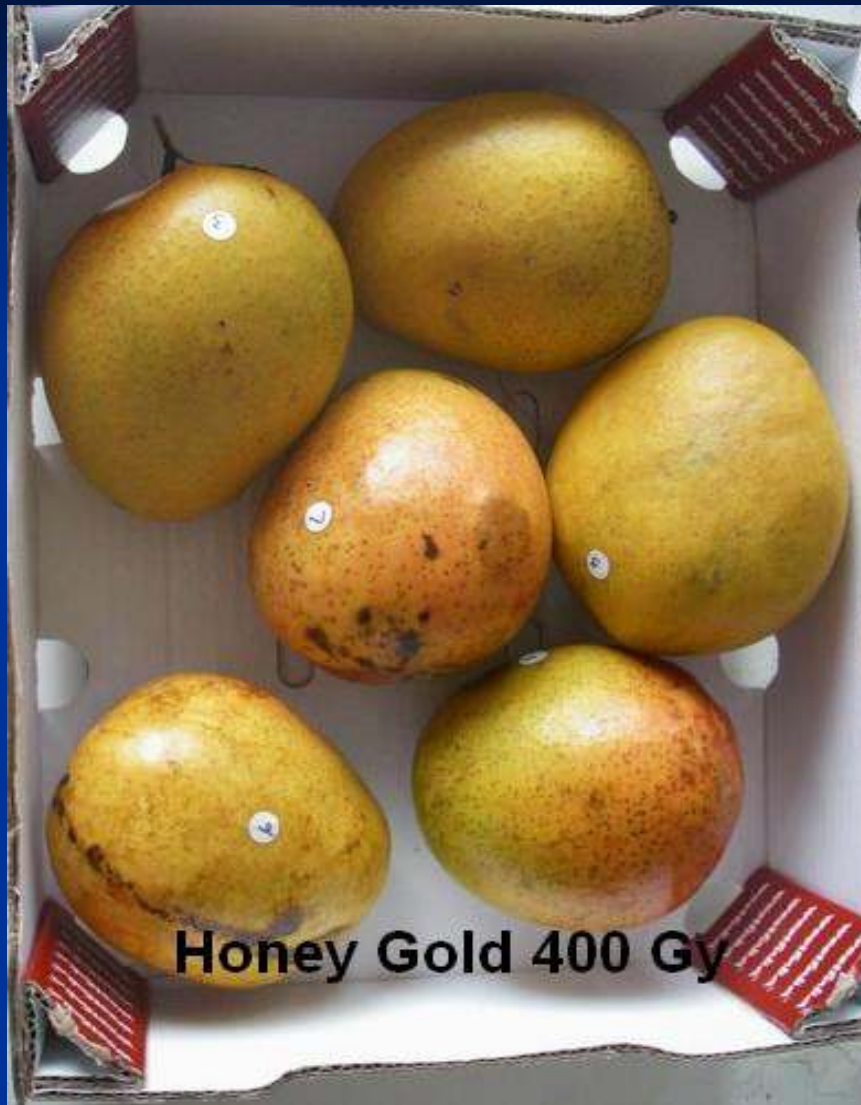




Honey Gold Control



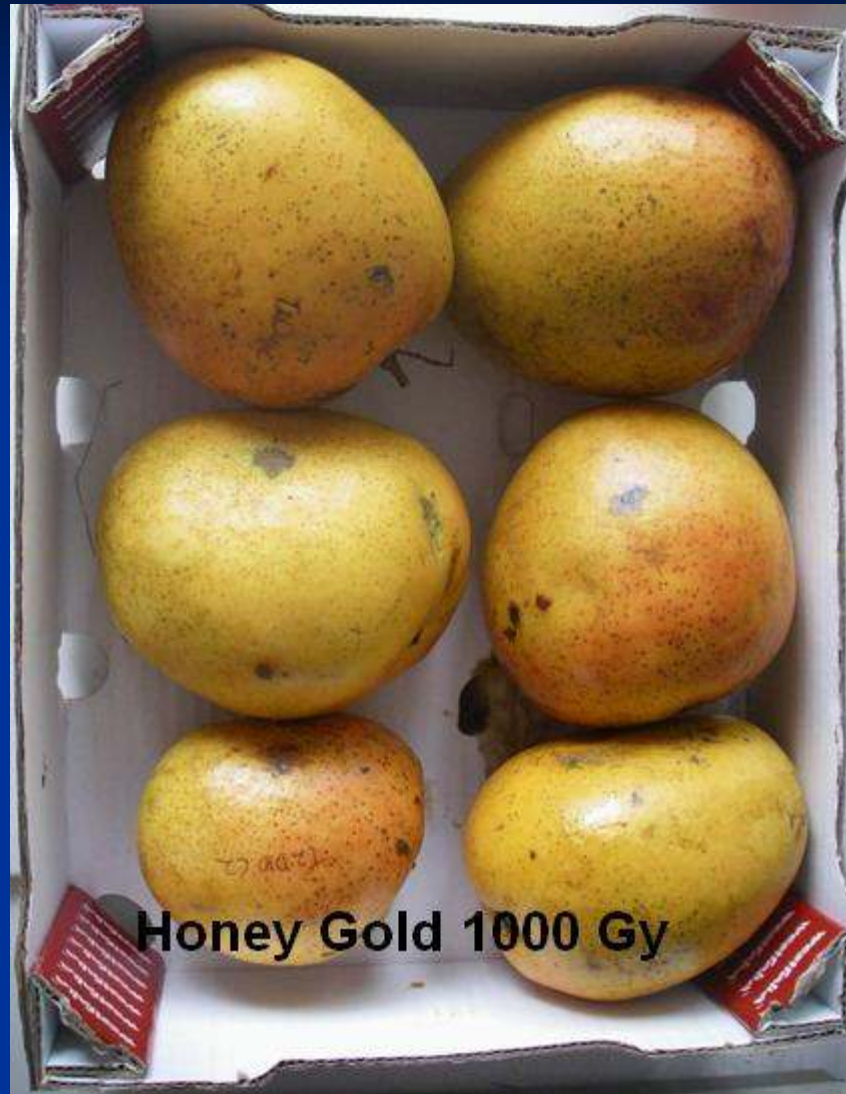
Honey Gold 300 Gy



Honey Gold 400 Gy



Honey Gold 600 Gy



Honey Gold 1000 Gy







Shelly 1000 Gy







Keitt 1000 Gy



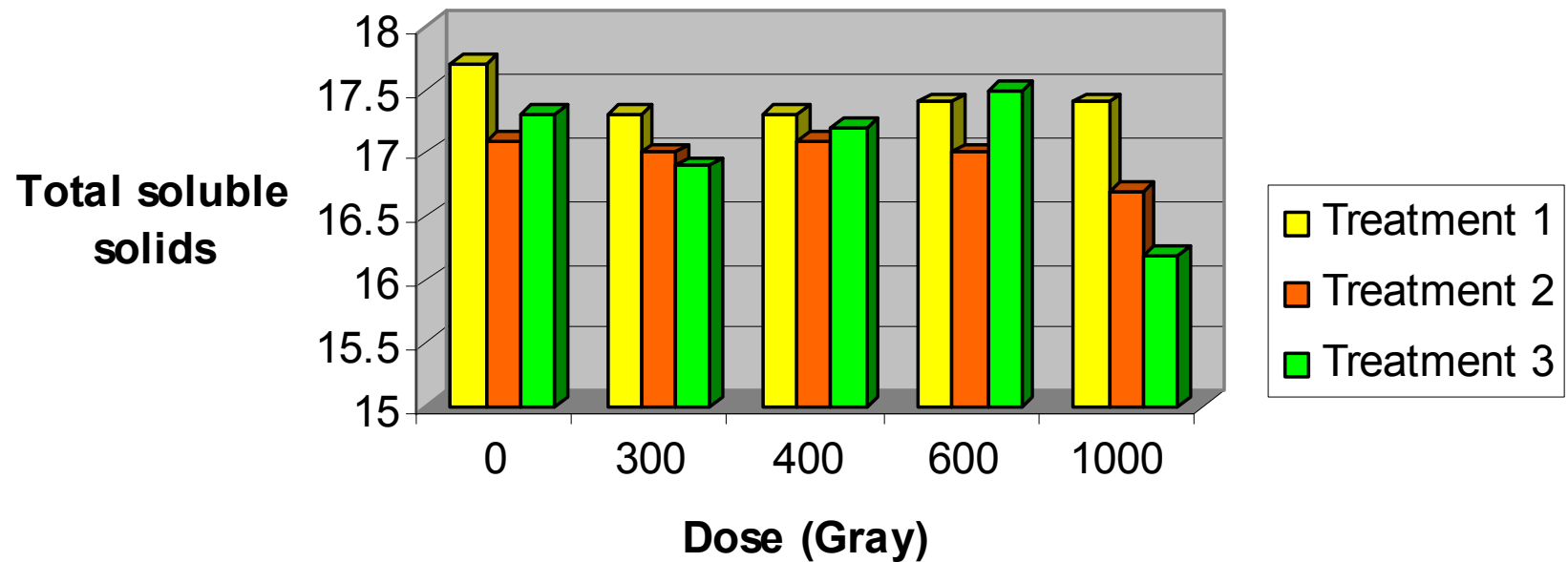




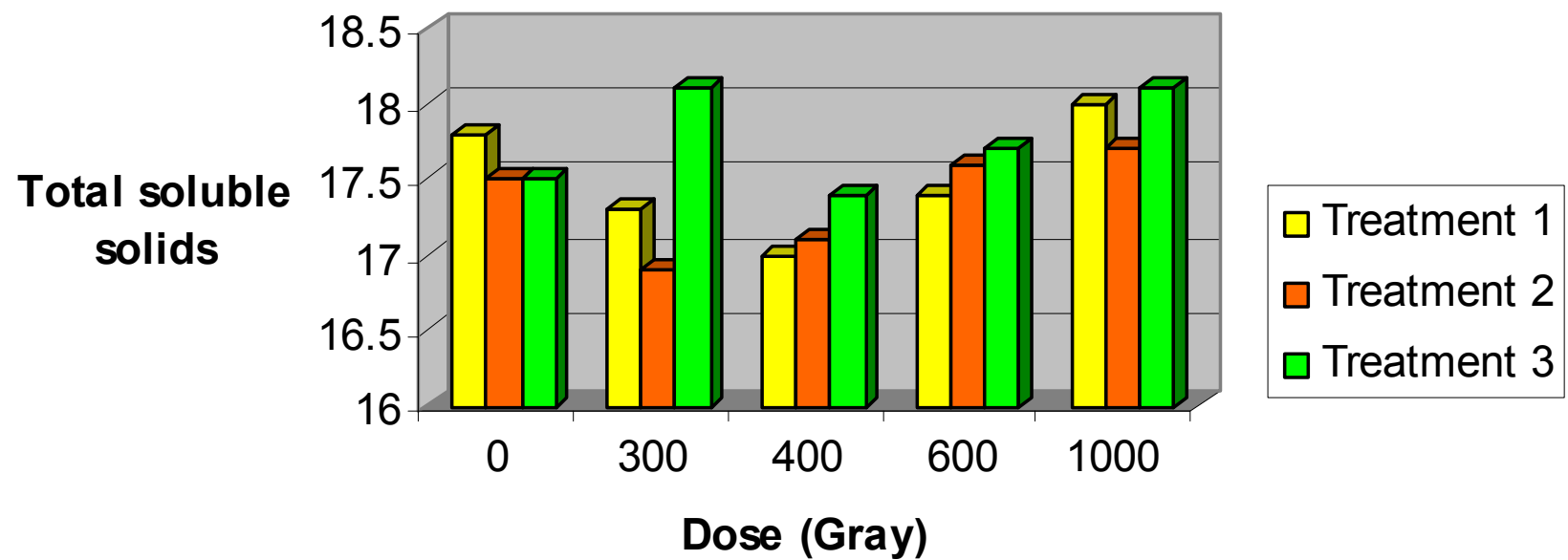
Kent 1000 Gy

TSS

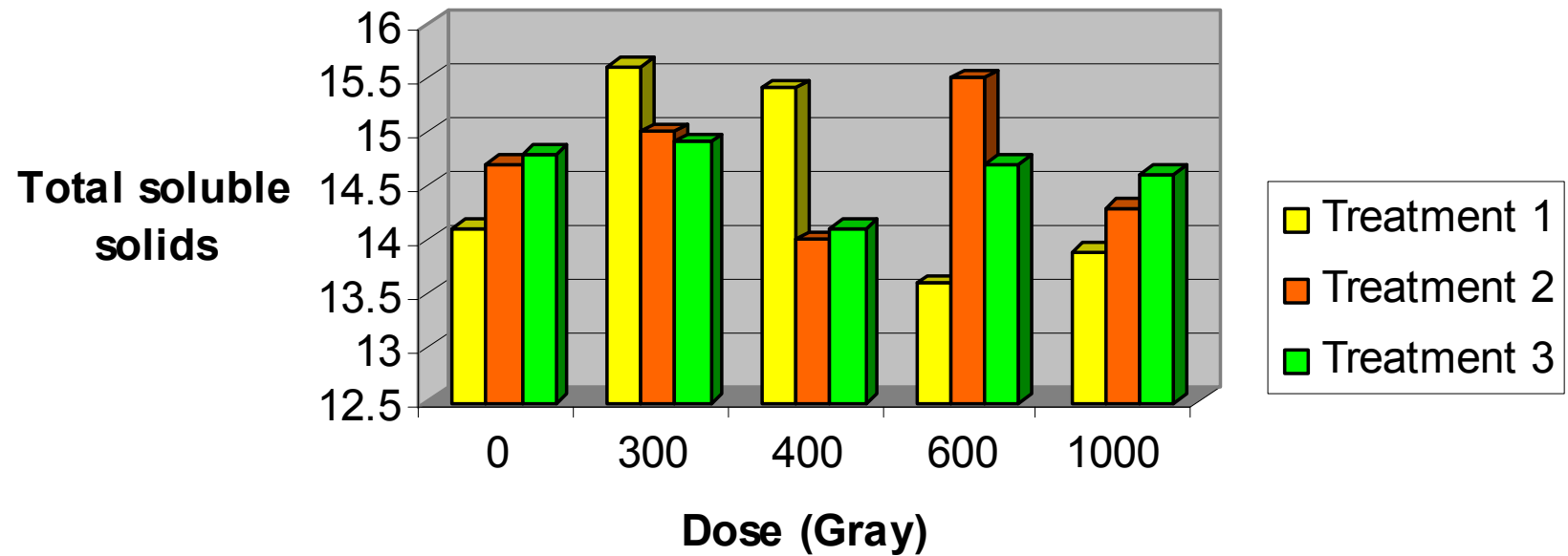
Honey Gold Total soluble solids (TSS) for all three treatments



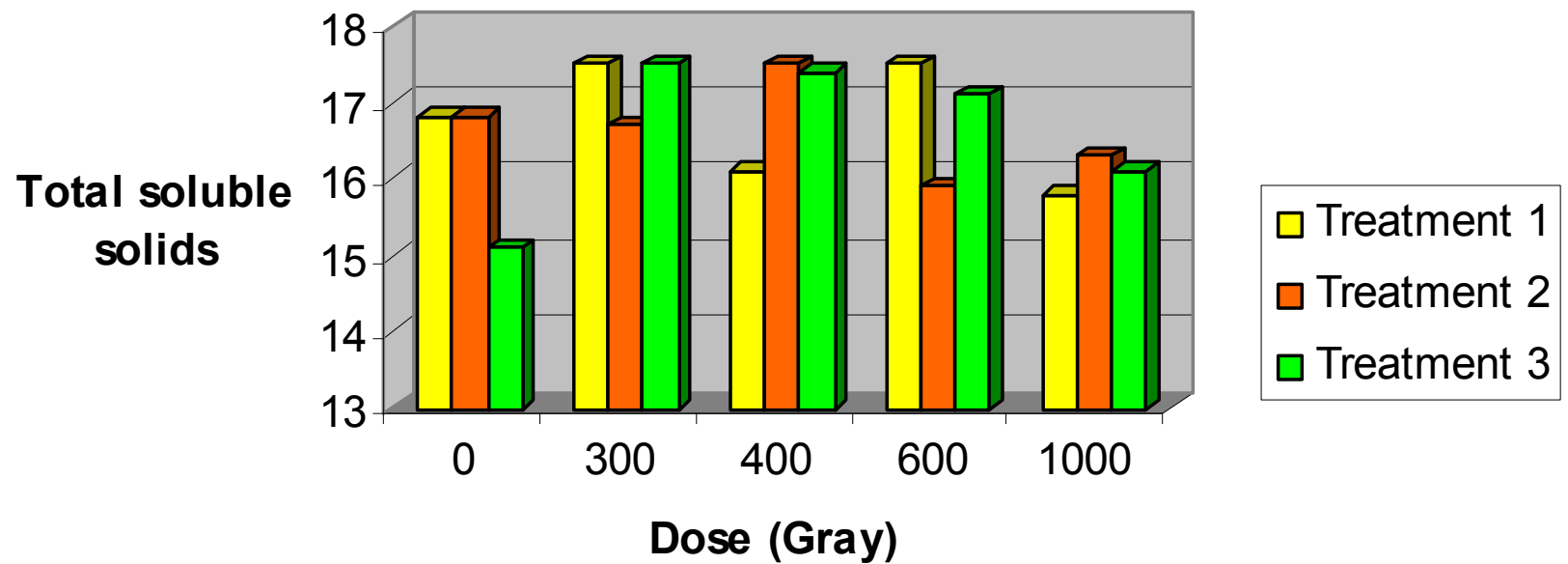
Shelly total soluble solids (TSS) for all three treatments



Keitt total soluble solids (TSS) for all three treatments



Kent total soluble solids (TSS) for all three treatments



■ Percentage moisture loss:

- Honey Gold 5-7%
- Shelly 10-12%
- Keitt 10-12%
- Kent 8-10%

■ No difference in taste

Problems

- Stem end rot and soft brown rot caused major losses
- Requires higher doses of Gamma radiation to control fungi - 1300 Gy



Stem end rot



Stem end rot on Shelly





Conclusion

- Post harvest diseases are a huge problem
- Cold damage does increase with increasing dose
- Lenticel damage increases with dose
- There is no large difference in:
 - Taste
 - Moisture loss

Acknowledgements

- Westfalia/Bavaria Funding
- WTS: Fruit Therese Bruwer and Zelda van Rooyen
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Thank you